Preimaginal stages of *Graphium (Pazala) eurous caschmirensis* (Rothschild 1895) (Lepidoptera: Papilionidae) in the Kumaon Himalaya, India

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Abstract: The preimaginal stages (starting with L_2) of *Graphium (Pazala) eurous caschmirensis* (Rothschild 1895) are illustrated. *Persea duthei* King ex J. D. Hooker and *Neolitsea umbrosa* (Nees) Gamble (both Lauraceae) are the larval foodplants of this taxon in the Kumaon Himalaya, not *Persea odoratissima* Nees as stated in the literature. The distribution of the taxon is commented upon.

Key words: *Graphium; eurous; mandarina; glycerion, caschmirensis; Persea duthiei; Persea odoratissima.*

Die Präimaginalstadien von *Graphium (Pazala) eurous caschmirensis* (Rothschild 1895) (Lepidoptera: Papilionidae) im Kumaon-Himalaja, Indien

Zusammenfassung: Die Präimaginalstadien (ab L_2) von *Graphium (Pazala) eurous caschmirensis* (Rothschild 1895) werden beschrieben und abgebildet. *Persea duthei* King ex J. D. Hooker und *Neolitsea umbrosa* (Nees) Gamble (beides Lauraceae) sind die larvalen Nahrungspflanzen im Kumaon-Himalaja, nicht *Persea odoratissima* Nees wie in der Literatur angegeben. Die Verbreitung der Art wird diskutiert.

Introduction

The subgenus *Pazala* Moore 1888 of *Graphium* Scopoli 1777 contains a group of Sino-Himalayan butterflies whose taxonomy remains unclear. In the western Himalaya, there are two species. Recently, Racheli & Cotton (2009) have treated these taxa as *Graphium (Pazala) eurous caschmirensis* Rothschild 1895 and *Graphium (Pazala) mandarinus garhwalica* Katayama 1986. For an in-depth review of the taxonomic confusion involving these two taxa and their current status, reference should be made to Racheli & Cotton (2009).

Both Gaonkar (1999) and Racheli & Cotton (2009) fully concur that "further detailed studies are needed" to satisfactorily establish the affinities of this subgenus. The present paper illustrates the early stages of *P. e. caschmirensis,* which will be useful for comparison with other taxa of this group when their immature stages are discovered.

Robson (1895a) reported a final instar larva of "*Papilio glycerion* Gray" feeding on the leaves of "*Machilus odoratissima* Nees" (= *Persea odoratissima,* Lauraceae) in Mussoorie, Garhwal, in the Indian state of Uttarakhand. Unfortunately, she did not illustrate the butterfly she bred. It should be noted that the larva was collected in June 1894 and that her paper was written in March 1895 and published in June 1895. The west Himalayan subspecies was described as *Papilio glycerion caschmirensis* Rothschild 1895 in the same year as Robson (1895a) described the early stages. Mackinnon & de Nicéville (1897) treated this taxon as *Papilio glycerion caschmirensis* Rothschild and illustrated the larva and pupa (Mackinnon & de Nicéville 1897: pl. W, figs. 25a–c), presumably the same individual as the one bred by Robson (1895a), and noted that Robson had published the preimaginal stages. The thoracic segments of the illustrated larva are rather different in shape from that described by Robson (1895a) or those photographed in the present study (Figs. 1–6).

It was not until Heron (1899) that the confusion between what are now considered *Graphium eurous* Leech 1893 and *Graphium mandarinus* Oberthür 1879 was recognized. Heron (1899) raised *Papilio caschmirensis* Rothschild to specific status. According to Racheli & Cotton (2009), it was later combined to *Papilio eurous caschmirensis*.

It should also be noted that, although the taxon is named "*caschmirensis*" and Rothschild's holotype in the Natural History Museum, London (= BMNH), is labeled "North Cashmere" (BMNH(E)#146435), this seems to be the only specimen said to be from Kashmir so far. The specimen of *G. eurous caschmirensis* erroneously figured as *Papilio glycerion* Gray by Westwood (1843) came from "Semlah", India (= ?Shimla, Himachal Pradesh, India), where a subsequent worker (de Rhé-Philipe 1931) could not find it. In fact, for this taxon he stated: "Recorded from 'Kashmir to Kumaon', but I have never come across it in the Simla Hills." De Rhé-Philipe (1931) based his observations not only on his own experiences comprising "occasional visits to Simla (= Shimla) between 1911 and 1921 and during a four year period of service there", but his list also "embodied all information and particulars I have gathered at various times from other collectors working in the area". *Persea duthie*i is reported from as far west as the Pakistan Himalaya, so it is possible that *G. eurous caschmirensis* occurs there, although it has not been reported from Pakistan yet (Roberts 2001).

While *G. eurous caschmirensis* is found in the outer as well as inner ranges of the Kumaon and Garhwal Himalaya, *G. mandarinus garhwalica* has so far been recorded only from the main Himalayan range in the vicinity of Joshimath, Garhwal, which is the type-locality. Robson (1895a) reported her larva from Mussoorie, in the outermost range of the Himalaya, where adults of *P. mandarinus* were not recorded by her contemporaries (Mackinnon & de Nicéville 1897), nor has the species been reported from Mussoorie in the intervening period, although it was one of the most intensively surveyed spots in India during the 20th century (Ollenbach 1929, Schull 1962).

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Material and methods

In 2008, 3 larvae of *G. eurous caschmirensis* were found in Maheshkhan forest (29°21′9″ N, 79°32′39″ E, altitude 1930 m) in Nainital district of the Kumaon Himalaya in May and June 2008, feeding on leaves of *Persea duthei* King ex J. D. Hooker and *Neolitsea umbrosa* (Nees) Gamble (Lauraceae). The first larva was in the third instar and the second larva was in the second instar. The third larva was in the third instar but did not survive, since it was injured. The first two were bred through in captivity and the various stages photographed.

The larvae were kept in separate plastic boxes and supplied with leaves of the plant they were found upon. No attempt was made to see whether they would change over from one host plant to the other.

Further larvae were observed but left *in situ*.

Observations

The larvae were always found on the upper side of leaves during the daytime, their colour making them rather difficult to spot. They were always found singly, the bushes of *Neolitsea umbrosa* never supporting more than one larva at a time.

They have no overt defensive strategy other than drawing the head into the body and keeping very still.

Talbot (1939), quoting Jordan (1909), reported that the larva of *G. eurous* was "green, dotted with black, the pronotum with yellow transverse band which is laterally continued to the anal segment, the three thoracic segments each with a pair of black spines, anal process yellow with black tip, curved laterad." This succinctly describes the 2nd (Figs. 1, 2), 3rd (Fig. 3) and 4th (Fig. 4) instars of *G. eurous caschmirensis* larvae noted in the present study.

Robson (1895a) noted the same points as Jordan (1909) for her larva and differed in noting that the "4th and 5th segments thickest and the larva tapers from the 5th segment to the 13th ... the 4th and 5th segments are furnished each with 2 subdorsal vermilion tubercles armed with a short black spine." This describes the final instar of *G. eurous caschmirensis* (Figs. 5, 6).

Robson (1895a) described the pupa as "1 inch long. It is of a brighter green than the larva, and is marked longitudinally with 4 ochreous yellow curved bars" (Figs. 7, 8, 9).

The pupa is entirely immobile.

Discussion

On the basis of the fact that *Graphium mandarinus garhwalica sensu* Racheli & Cotton (2009) has not been reported from Mussoorie and that the description of the larva and pupa by Robson (1895a) match the individuals bred in the present study, from which adults of *Graphium eurous caschmirensis sensu* Racheli & Cotton (2009) emerged (Figs. 10, 11), it is reasonable to state that Robson (1895a) bred *G. eurous caschmirensis* in Mussoorie.

Both the larval host plants recorded in the present study occur at moderate elevation in Kumaon, between 1500 m and 2740 m for *P. duthiei* and between 1370 m and 2440 m for *Neolitsea umbrosa* (Osmaston 1927).

It is of interest that in the Western Himalaya, *Persea odoratissima* and *Persea duthei* occupy different altitudinal belts, with the former being found between 760 m and 2130 m while *P. duthiei* occurs at higher elevation.

Around 1500 m in the Bhimtal valley in Nainital district, Kumaon Himalaya, Uttarakhand, where only *Persea odoratissima* occurs, *G. eurous* is not found except as a rare straggler. However, Robson (1895a) reports *P. odoratissima* as the larval host plant of *Pazala eurous caschmirensis* (*sensu* Racheli & Cotton 2009). If *P. eurous caschmirensis* actually fed on *Persea odoratissima*, there is no reason to prevent its colonisation of the lower hills in the Kumaon Himalaya, even as low as 760 m, since *P. odoratissima* is found down to that elevation. As a matter of fact, breeding populations of *P. eurous cashmirensis* are only found above 1800 m in this area. Therefore, it seems more than likely that the plant upon which Robson (1895a) bred her specimen was misidentified, and in fact the plant was *Persea duthiei*, which is common in Mussoorie. In another note, Robson (1895b) stated that "I found a larva of *Papilio cloanthus*, Westwood, on a large and common tree — not a shrub — identified as *Machilus odoratissima*, Nees, on which also feed the larva of *Papilio sarpedon*, Linnaeus, *P. glycerion*, Westwood, and *P. govindra*, Moore." It should be stated that *P. odoratissima* and *P. duthiei* are very similar in appearance and it would not be impossible to confuse the two species.

It may be noted from Robson (1895b) that the plant was identified for her in 1894. It is very likely that the person who identified the plant was not familiar with *Persea duthiei*, since this species was only described (as *Machilus duthiei*) 4 years earlier (Hooker 1890). Although there are no published reports of the 3 species (*Graphium sarpedon* Linnaeus, *Graphium cloanthus* Westwood and *Papilio agestor govindra* Moore) having been bred on *Persea duthiei*, *P. agestor govindra* has been bred on it (Smetacek & Smetacek 2011), and there is little doubt that both *G. sarpedon* and *G. cloanthus* feed on it, since both these species ascend to 2750 m in the western Himalaya (Wynter-Blyth 1957; unpubl. obs.), while *Persea odoratissima* does not ascend above 2130 m in the Western Himalaya (Osmaston 1927). *G. sarpedon* feeds on *Persea odoratissima* in the Bhimtal valley (unpubl. obs.) and *G. cloanthus* and *P. agestor* probably do so, too, since they are common at much lower elevation than the lower limit of *Persea duthiei*.

Robson's (1895a) report has been included in Mackinnon & de Nicéville (1897), Jordan (1909), Talbot (1939), Sevastopulo (1973) and Robinson et al. (2001).

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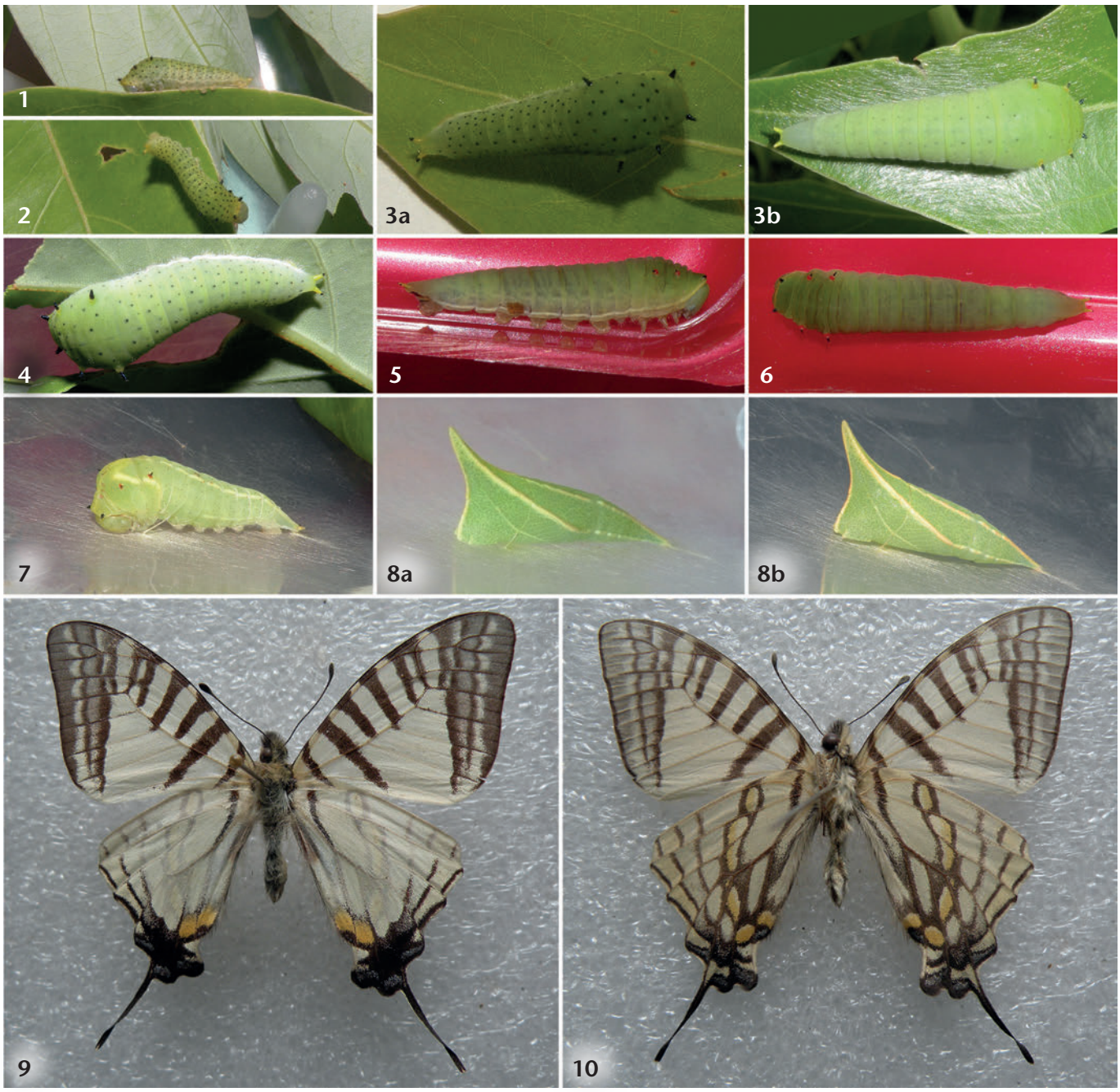

Plate: *Graphium eurous caschmirensis,* larval instars, pupa and imago. **Figs. 1–2:** 2nd instar larva (L_2); **Fig. 1:** lateral, **Fig. 2:** dorsal view. **Figs. 3a–3b:** L_3, dorsal view; **Fig. 3a:** natural light, **Fig. 3b:** flashlight. **Fig. 4:** L_4, dorsal view. **Figs. 5–6:** final instar (L_5); **Fig. 5:** lateral, **Fig. 6:** dorsal view. **Fig. 7:** prepupa, beginning pupation. **Figs. 8a–8b:** pupa; **Fig. 8a:** natural light, **Fig. 8b:** flashlight. **Figs. 9–10:** imago (specimen collected in the wild); **Fig. 9:** upperside (recto), **Fig. 10:** underside (verso).

Conclusion

Therefore, it would be useful for future workers attempting to clarify the taxonomic problem in the *Pazala* subgenus to treat Robson's (1895a) specimen as *G. eurous caschmirensis*, not *G. glycerion* (= *Graphium mandarinus sensu* Racheli & Cotton 2009) and treat the larval host plant as *Persea duthiei*, not *Persea odoratissima*.

P. mandarinus has not been bred so far, nor is the larval host plant known.

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